Space Weather Technical Forecast

Issued on Sunday, 12 June 2022 at 01:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight but increasing chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was Low in the last 24 hours, with two minor C-class flares that originated from near the northeastern limb. There are currently two sunspots on the visible disc, one of which is large with some magnetic complexity and was linked to an M-flare on 10 June. No Earth directed CMEs were observed in available imagery, with yesterday's filament eruption being assessed as missing ahead of Earth's orbit.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1, has been at mostly background levels during the last 24 hours, but with some signs of weak coronal hole influences, perhaps from CH87. Wind speeds were ambient, increasing slightly from 300 km/s, to around 370 km/s. Density has been above average, peaking at 30 ppcc between 11/1250-1320 UTC. Interplanetary magnetic field strength, Bt, has been weak with brief moderate peaks. The north-south component, Bz, has varied weakly between +/-7 nT. The phi angle was variable at first, before settling mostly positive (away from the Sun) from 11/1200 UTC. Geomagnetic activity was Quiet (Kp 1-2) with an Unsettled (Kp 3) interval between 11/0600-0900 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) was at Background levels.
Electron flux (greater than 2MeV) was also at background levels. Corresponding 24-hour integrated electron fluence has been well below the Active (1e8 integrated pfu) threshold on a largely steady trend, with 1.65e6 integrated pfu observed at 12/0000UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be mainly Low through this period, with C-class flares likely and a slight chance of M-class flares. However some bright flux can be observed in satellite imagery, suggesting further sunspot regions may rotate onto the disc in the near future, with a slight increase in associated flare probabilities.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs were observed in available satellite imagery. Solar winds are expected to be mainly at background levels initially, with some enhancements possible, due to small and transient coronal holes. An increase near to 500 km/s was observed at the STEREO-A spacecraft, which may reach Earth during Day 1 (12 June). CH91/+ is then likely to give another enhancement later Day 3 or on Day 4 (14-15 June). However, geomagnetic response from coronal hole high speed streams is usually muted near the solstice. As such, geomagnetic activity is expected to be mainly Quiet to Unsettled, with a chance of Active intervals, especially on Days 1 and 4.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is expected to be at background levels during this period. However, there is a very slight increase in the chance of S1 as AR3030 transits westwards.
High energy electron flux (greater than 2 MeV) is expected to start at background levels, perhaps increasing to moderate levels during the period due to high speed stream influences.

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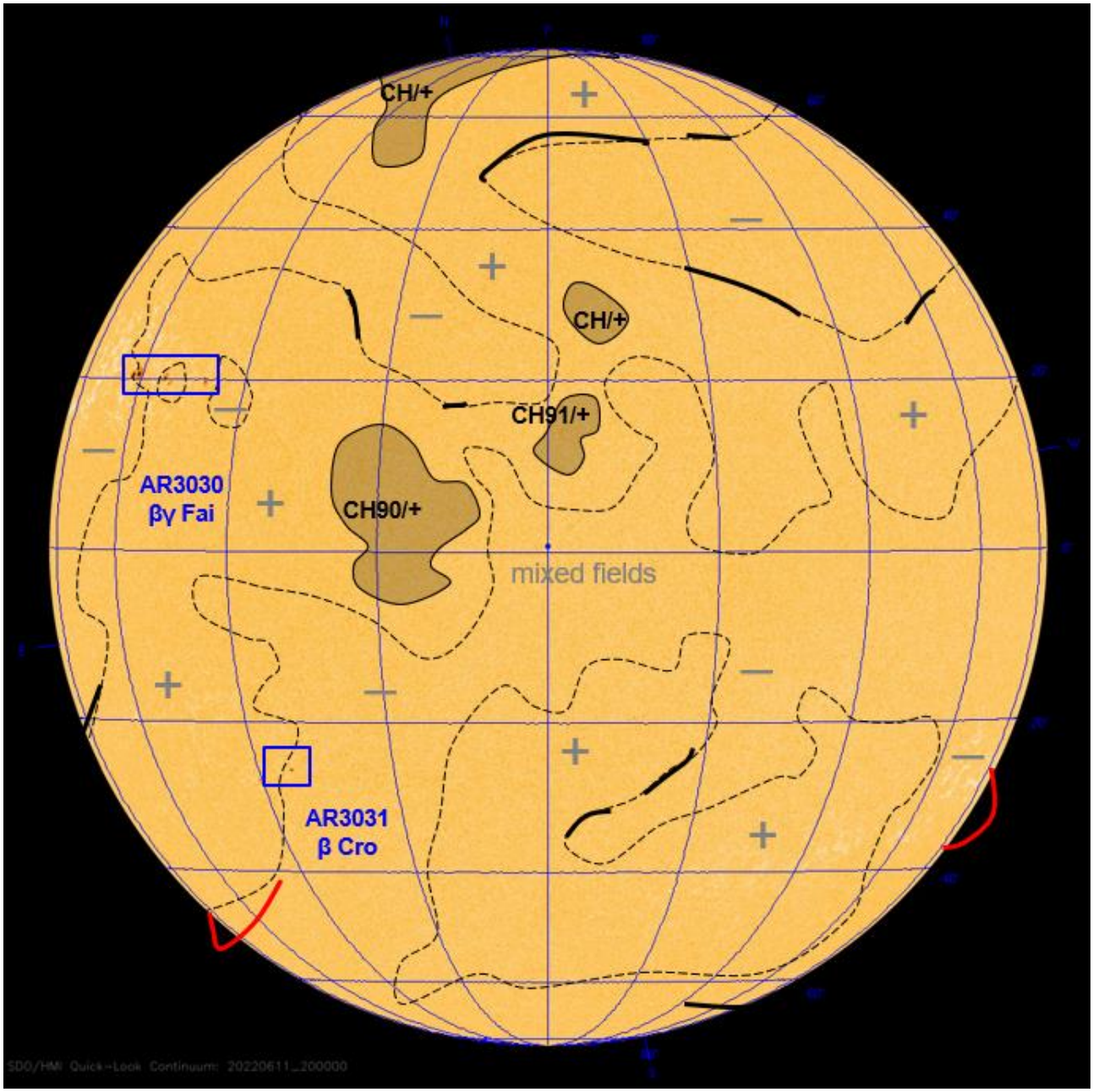
Electron fluence is expected to remain below the Active threshold throughout, possibly with an increasing trend.

Figure 1. Solar Analysis Valid 11/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs were observed in available satellite imagery.

Solar winds are expected to be mainly at background levels initially. Some enhancements are possible though, due to the presence of small and transient coronal holes, for instance CH89/+ that was observed a few days ago. Whilst not evident on current AIA-193 imagery, historically there has also been a small coronal hole visible in the northwest quadrant with a larger analogue from previous rotations. This may be the cause of an increase near to 500 km/s in the observed solar wind speed at the STEREO-A spacecraft, an increase that is also suggested by the latest MOSWOC Enlil modelling. If STEREO-A timings are to be believed, this may reach Earth during Day 1 (12 June). CH91/+ is then likely to arrive later Day 3 or on Day 4 (14-15 June). However, geomagnetic response from coronal hole high speed streams is usually muted near the solstice and as such significant geomagnetic activity is not expected.

Overall, geomagnetic activity is expected to be mainly Quiet to Unsettled, with a chance of Active intervals, especially on Days 1 and 4.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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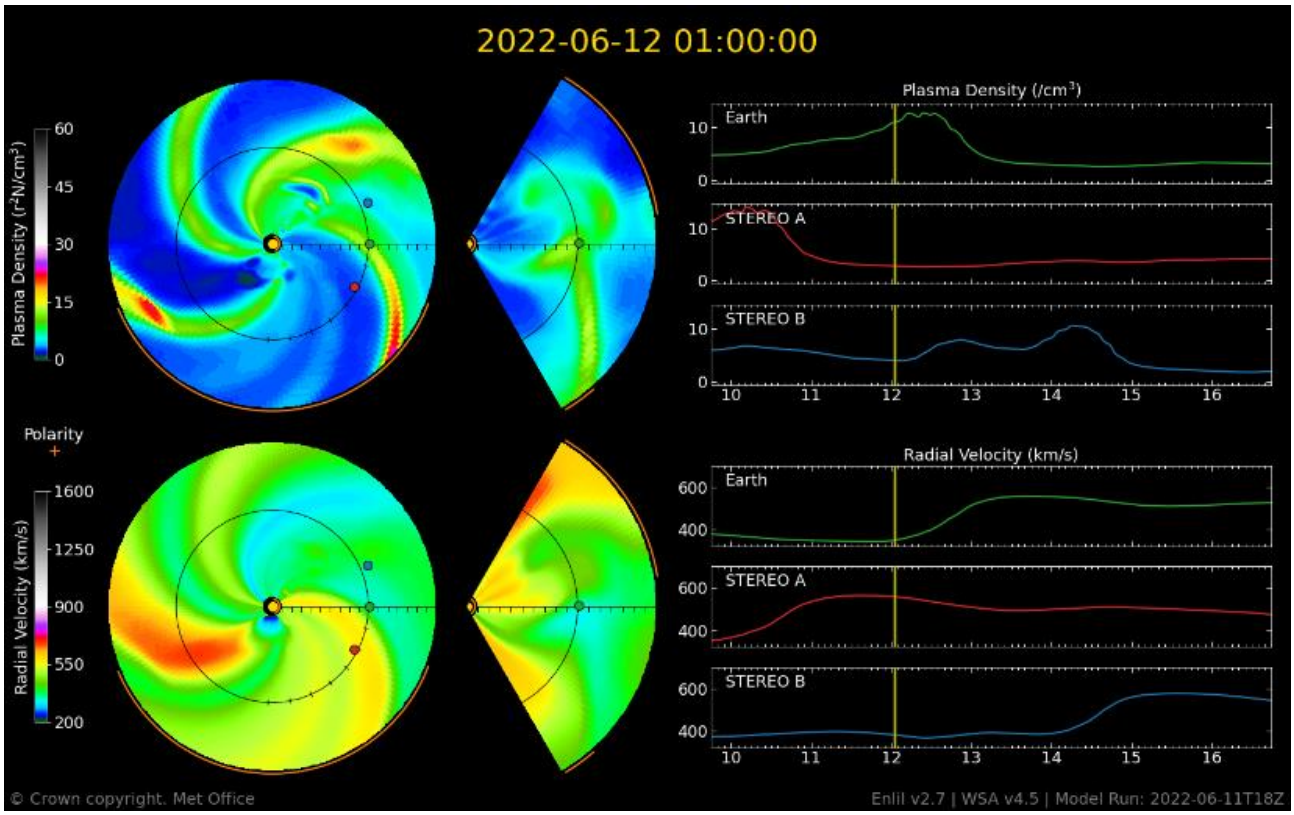
Figure 2: MOSWOC Enlil suggesting an increase in wind speeds through Day 1 (12 June). This correlates well with STEREO-A observations, although the coronal hole source is a little uncertain.



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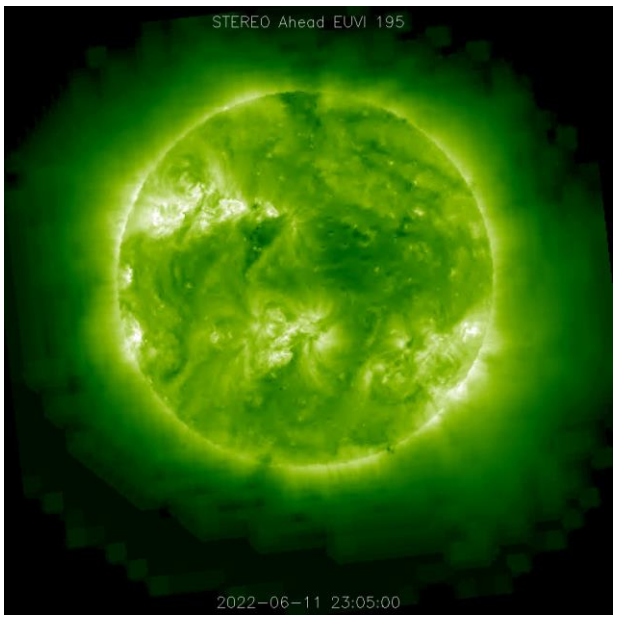
Radio Blackouts - X-Ray Flares:
Solar activity was Low in the last 24 hours, with two C-class flares that originated from near the northeast limb.

There are two sunspot regions on the visible disc, with AR3029 fading and a NEW region near AR3030 in the northeast now being treated as a part of this region. This means AR3030 is now classified Fai/Beta-gamma. It has not shown significant change in recent hours, but is large and moderately complex, with a history of an M-class flare from near this region on 10 June. AR3031 (now classified Bxo/Beta) in the southeast was showing signs of growth but has since faded in recent hours. The eastern limb remains an area to watch with STEREO-A imagery and far side seismographs suggesting potential for further sunspot regions to rotate onto the disc in the near future.

Currently C-class flares are likely with a slight chance of M-class flares. However, a slight increase in probabilities is suggested through the next couple of days with the possibility of further regions rotating onto the disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	25	30	30
Very Active	R3 to R5 X Class	No	2	3	5	5

Figure 3: STEREO-A EUVI-195 imagery showing bright flux near the east limb, which may be further sunspot regions to rotate onto the visible disc.



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Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) is at background levels and is expected to remain at this level, although with a slight increase towards the end of the period as AR3030 transits westwards.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	2	3
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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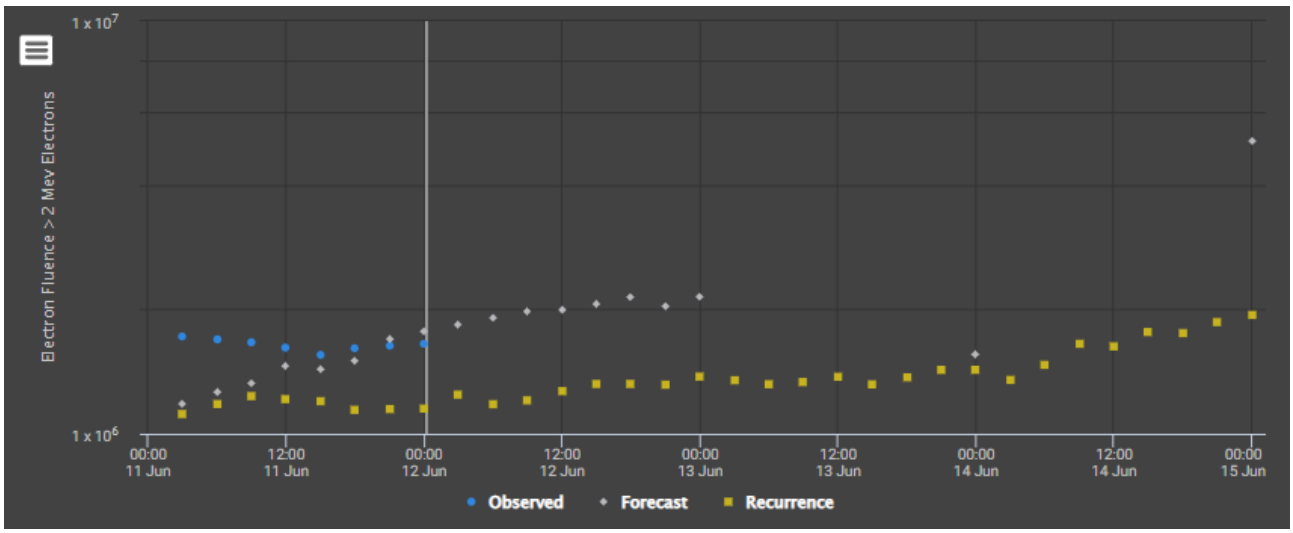
High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) is expected to remain at mainly background levels through the start of this period. Possible high speed stream influences may give an increase in wind speeds through this period, which could start to cause some minor electron charging. However, geomagnetic response is expected to be limited and as such charging may also be minor. Therefore a slight increasing trend is possible, perhaps reaching moderate levels during the period.

Electron fluence is currently well below the Active (1e8 integrated pfu) threshold. Whilst a rising trend is possible in response to any flux increase, it is unlikely to reach Active during the period. MOSWOC REFM also indicates a slight rising trend well below Active which is considered good guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	5	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: MOSWOC REFM showing a slight increasing trend well below the Active (1e8 integrated pfu) threshold. This is considered good guidance.



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